

# Transformations of Functions

$$a f(b(x-c)) + d \rightarrow \text{shift up and down}$$

negative = reflect over x-axis

vertical stretch/shrink

$|a| > 1$  = stretch

$0 < |a| < 1$  = shrink

shift left and right

$(x-c)$  = right

$(x+c)$  = left

negative = reflect over y-axis

horizontal stretch/shrink

\* inside ( ) is opposite

$|b| > 1$  → compression

$0 < |b| < 1$  → stretch

Ex 1:  $y = -2(x+4)^2 + 1$

reflected over x

vertical stretch

shift left

shift up 1

Ex 2:  $y = \sqrt{-x} + 4$

reflect over y-axis

shift up 4

